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RESEARCH REPORT NO. 90

HISTORY OF DRAINAGE CHANNEL IMPROVEMENT IN THE VERMILION RIVER WATERSHED, WABASH BASIN

By RALPH C. HAY
and JOHN B. STALL

ILLINOIS STATE WATER SURVEY
URBANA, ILLINOIS

UNIVERSITY OF ILLINOIS
AT URBANA-CHAMPAIGN

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F I N A L R E P O R T
Project No.
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Urbana, Illinois 61801

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OBJECTIVES

1. To document stream conditions for the natural prairies of central Illinois, in what is now the Corn Belt, as they existed about 150 years ago at the time this area was settled by pioneers.

2. To trace to a major degree and document the physical man-made changes in the Vermilion River, and changes in the water environment; to trace to a minor degree changes in the quality of life, in agricultural production and in economic conditions all as related to drainage channel improvements in east-central Illinois.

3. To trace over the past 150 years the social attitudes, needs, problems, methodologies, and accomplishments as a result of the development of channel improvements in the east-central Illinois prairies.

4. To relate the 1974 hydraulic conditions of the Vermilion River stream system to past drainage channel improvement developments to provide a frame of reference for future decision-making regarding stream channelization, the environment, and man's needs and welfare.

BACKGROUND

Today any water resource proposal is required to provide an environmental impact statement describing the damages and benefits that may result to the environment. Environmental costs and benefits are now considered crucial elements in evaluating the project. This study has developed from interest in both present day environmental concerns and more than a century of drainage improvements.

In recent years stream channel modifications intended to provide better drainage and flood protection have come under serious criticism especially by environmentally oriented groups. Some of this opposition has become extremely critical. For example, an article in Reader's Digest by Miller (1970) focused public attention on and aroused opposition to projects involving "dredging" and "channelization of natural streams." More recently, James Modson's (1972) article in Audubon Magazine made a critical attack on channelization. Opposition and criticism have been focused to a considerable extent on projects planned and executed by the Corps of Engineers and the

Soil Conservation Service. Critical views have been expressed by Congress in House Report No. 93-530 (1973) issued by the 93rd Congress entitled "Stream Channelization: What Federally Financed Draglines and Bulldozers Do to Our Nation's Streams." [This report has been cited twice recently in editorials of the Champaign-Urbana Courier.]

Criticism is also being felt by local drainage districts. Channel improvement projects in east-central Illinois in the Saline Branch Drainage District in Champaign County and Scattering Fork Drainage District in Douglas County have been under verbal and legal attacks by environmentalists. Only the Scattering Fork project, now completed, has had federal technical and financial assistance from the Soil Conservation Service. The Saline Branch ditch-clearing project, still delayed by litigation, is being financed entirely from local resources.

In these two cases, and in hundreds of others in Illinois, drainage improvements consist of constructed channels which require periodic maintenance to serve their intended purpose. Recognition of these problems has had a direct influence on initiation of this study. The writers believe there is need to develop better understanding of and appreciation for the efforts of the past to organize legal drainage districts and construct these many drainage channels. Figure 1 shows a modern dragline cleaning out a drainage channel, and figure 2 shows a dredge boat used in Illinois at the turn of the century.

Figure 1. Modern dragline cleaning a drainage channel. (Courtesy of the Soil Conservation Service)

Figure 2. A floating dredge boat at work on Camp Creek Special Drainage District west of Seymour in Champaign County on June 30, 1907. The dipper or shovel is submerged at the end of the vertical beam. A similar dredge was used during that same period for dredging Beaver Lake and Saline Branch. (Courtesy Champaign County Historical Society)

These hundreds of small units of government, the drainage districts, in Illinois contribute substantially to the great number of local government bodies, more than in any other state. In 1974, a period of land use changes, water resource planning, and environmental protection, drainage districts face an uncertain and hazardous future. Hopefully this study may help develop perspective for those who plan the future of local drainage districts and their many channels.

Acknowledgments

This study has been produced largely by Ralph C. Hay. A Professor of Agricultural Engineering Emeritus at the University of Illinois with long experience in land drainage, Mr. Hay was employed one-fifth time at the Illinois State Water Survey as Engineer for the one-year duration of this project.

The project was carried out at the Illinois State Water Survey under the general supervision of Dr. William C. Ackermann, Chief. It was based on an idea of John B. Stall, Head of the Hydrology Section, who directed the project. Norman G. Dickey, student technical assistant, worked part-time on the project. Drafting was done by John Brother, William Motherway, and Linda Riggin of the Graphic Arts Section. Mrs. J. Loreena Ivens and Mrs. Patricia A. Motherway edited the final report. Photographs in the report not otherwise credited were taken by Ralph C. Hay.

The Technical Advisory Committee to the project included Benjamin A. Jones, Jr., Associate Director, Agricultural Experiment Station, and Professor of Agricultural Engineering; and Robert M. Sutton, Director, Illinois State Historical Survey, and Chairman, History Department, University of Illinois.

Figure 3. George W. Pickels, Professor of Civil Engineering at the University of Illinois until 1944, writer and teacher of drainage technology and accomplishments.

No study of drainage matters in Illinois would be adequate without a special acknowledgment of the extensive early work of Professor George W. Pickels (figure 3), Civil Engineering Department of the University of Illinois. He was an outstanding teacher of drainage and flood control and author of a text *Drainage and Flood Control Engineering* published in 1925 and 1941 by McGraw Hill. The text has been widely used and is still useful in 1974. Professor Pickels, with F. B. Leonard, Jr., wrote *Engineering and Legal Aspects of Land Drainage in Illinois*, printed in 1921 as Bulletin 42 of the Illinois State Geological Survey. It is a thorough and accurate description of many drainage district accomplishments, highly useful to this research study.

Extensive historical and factual information was obtained by Professor Hay by interviewing many long-time residents of the Vermilion River watershed. Much help was obtained in this way from: Anna Irle Pierce, Leverett: William H. Irle, Thomasboro; George Arends, Melvin; C. D. Thompson, Melvin; Eldred

Cornelius, Penfield; Clyde I. Day, Gibson City; Dale Cronkhite, Danville; Ralph D. Wilson, Champaign; Frank Meier, Thomasboro; and Ben F. Muirheid, Champaign.

Commentary by the Senior Author, Ralph C. Hay

My family history involves some of the problems and hardships found in swampy Corn Belt land prior to drainage districts.

Shortly after the Civil War my grandparents, John and Lura Hay, as a young couple, migrated from Clinton, Indiana, to north central Iowa. My father, Charles Franklin, was born in 1875 in Pocahontas County. This area was level and swampy. According to Iowa State engineers, a century ago as much as one-third of that county stood under water in rainy seasons. This poor drainage, crop failures, mosquitoes, cold winters, and too many roving Indians, according to family notes, caused them to leave Iowa in despair. About 1880 they started by covered wagon for Texas, but high water in streams stopped them about 50 miles south of Kansas City. My grandfather then bought a farm in Miami County, Kansas, on one of the highest ridges. I can remember this poor rocky tract, suitable only for pasture, but certainly well drained. With drainage, the land my grandfather left in Iowa has become rich black productive soil, some of the best in the Corn Belt.

My early interest in drainage was casual as it developed in college studies. I liked Pickels' text, *Drainage and Flood Control Engineering*, which we used at Kansas State. Then a trip across central Illinois on US 36 in 1931 proved to be exciting. Quickly I came to appreciate the importance of the many drainage channels in this rich agricultural region. I joined the University of Illinois staff a year later, and have maintained some contact with agricultural drainage for over 40 years. I have taught it in Agricultural Engineering courses and studied it in field work, especially as related to Soil Conservation districts.

My more specific appreciation of the importance and magnitude of the problems of drainage districts has developed in recent years. I have been a consultant for commissioners of three drainage districts to assist on specific problem situations. This study has become a challenge to learn more, and hopefully to contribute to improved drainage and better use of water resources in the future.

PROCEDURES

This study has been limited to one watershed, the Vermilion River of the Wabash. Four Illinois streams bear the name Vermilion. Pickels (1921) termed this river the "Big Vermilion," a name still used locally. This 1250-square-mile, or 800,000-acre, watershed lies almost entirely within Ford, Champaign, and Vermilion Counties as shown on the map in figure 4. This particular area

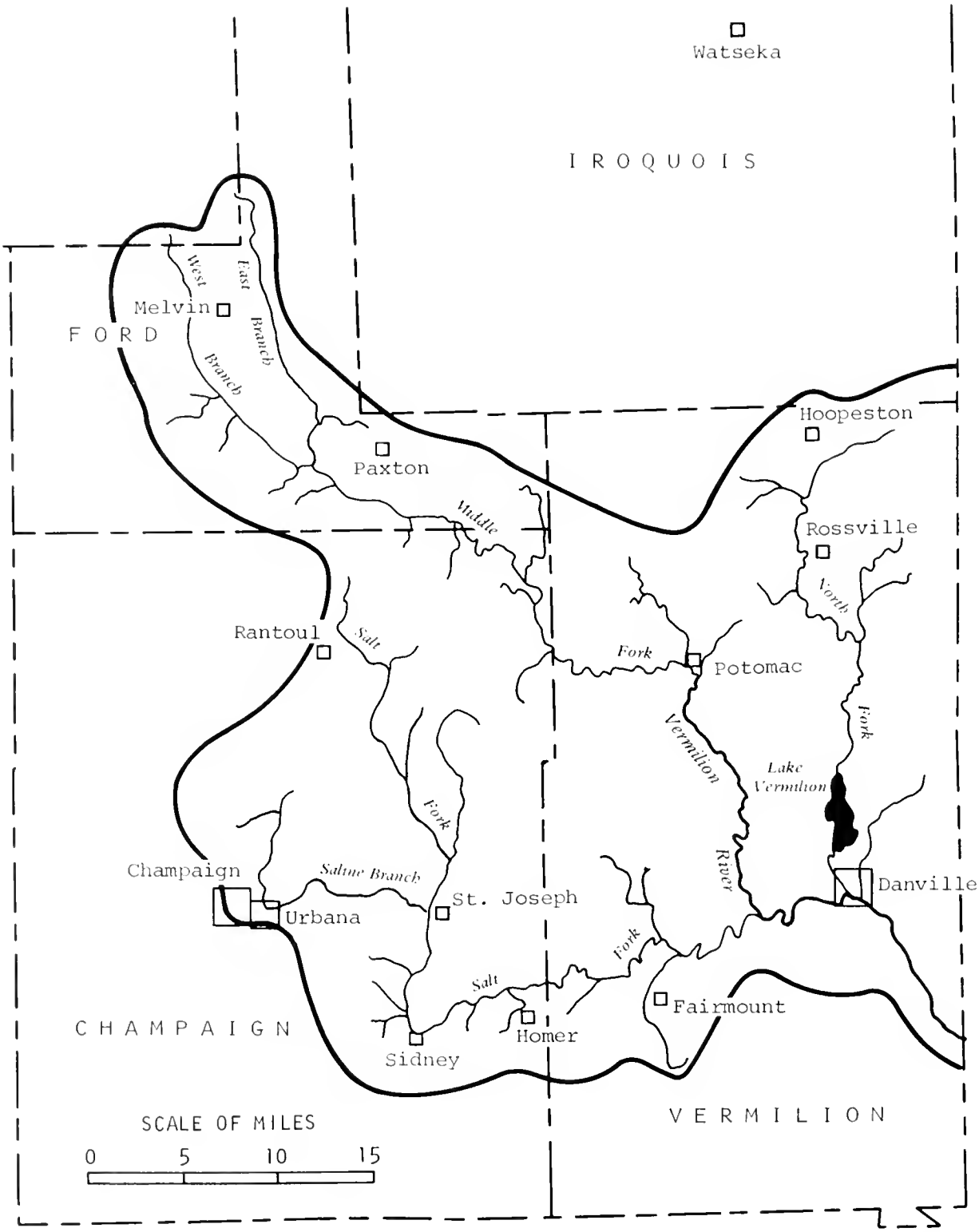

Figure 4. Vermilion River watershed in Champaign, Ford, and Vermilion Counties in east-central Illinois.

has been chosen because of its proximity to the University of Illinois campus which allowed us to meet the limitations of budget and manpower.

A further constraint on this research has been to study only open channels in agricultural areas which make up a high percentage of the watershed. Tile drainage has been considered only as a part of the drainage districts outlets; however, it is recognized that the channels almost always serve as outlets for tile drainage systems both on individual farms and smaller subdistricts. At least 15 districts have no ditches, and large tiles serve as the only outlets. Several districts in Champaign County also maintain shallow surface channels parallel to the outlet tile. No attempt has been made to chart the history and development of tile drainage practices.

The only major constructed urban drainage channel of the watershed is the Boneyard ditch in Urbana-Champaign. It is now the subject of extensive studies. Hence is has also been eliminated from study under this project.

Research of the first few months was directed toward becoming acquainted with the watershed itself and with the organization of the significant government bodies dealing with land drainage in the three counties. This entailed study of numerous maps and publications. The watershed lies within an area covered by 24 topographic maps of the U. S. Geological Survey. A set of these maps, marked to identify drainage channels, has been used to locate drainage districts and watershed boundaries in the office and in field trips.

The identification of 105 drainage districts has been accomplished through use of the two-volume inventory issued by the Illinois Department of Business and Economic Development (1971). This publication contains maps of counties and numerous districts and a numbering system which has been used with minor alterations in this study. Maps of Champaign, Ford, and Vermilion Counties in figures 5, 6, and 7 show the drainage districts which are listed in tables 1, 2, and 3. This inventory has proved to be extremely helpful in this study, and can be a valuable guide in similar area studies within Illinois.

The only other complete listing and description of drainage districts was made 50 years earlier by Pickels and Leonard (1921). This remarkably thorough publication has been especially useful in developing understanding of both the geography and history of the channels and the legal problems and requirements in forming the districts. When it was prepared in 1920 there were 63 organized drainage districts containing 317,860 acres in the watershed as compared with 105 districts totaling 398,266 acres in 1971, slightly less than 50 percent of the watershed. [This 1971 total includes district overlaps and is consequently slightly high.]

Other valuable sources were the 1934 reports on Illinois drainage districts by the Federal Land Bank of St. Louis. These reports were prepared under the direction of W. R. Parkhill, F. H. Schreiner, and W. A. Kelly, Engineer Appraisers of the Land Bank, as a guide in evaluating farm loan applications in the period following the depression. Copies of single-volume reports for Ford and Vermilion County districts within the watershed and a three-volume report on all

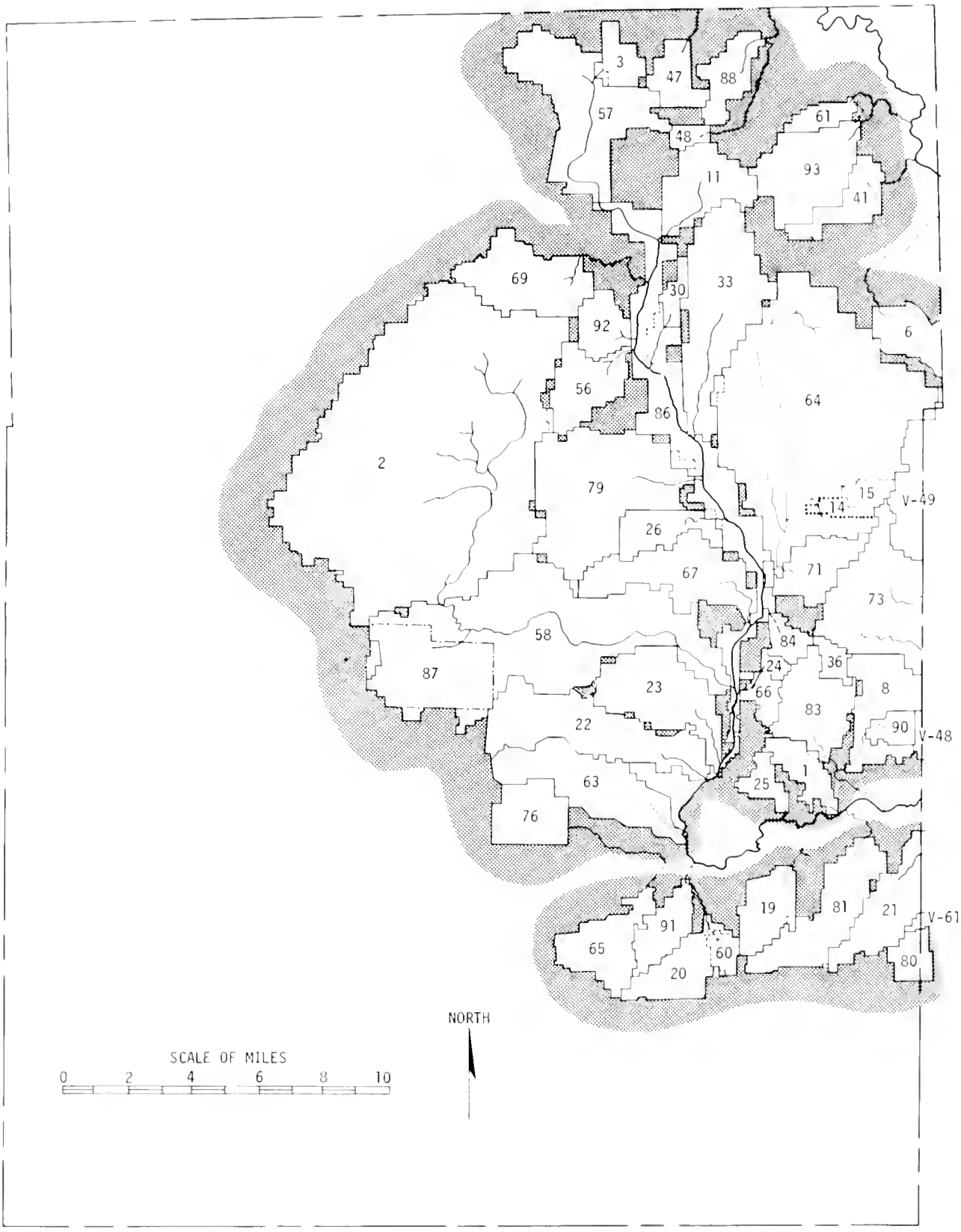

Figure 5. Drainage districts in Champaign County. (See table 1 for identification)

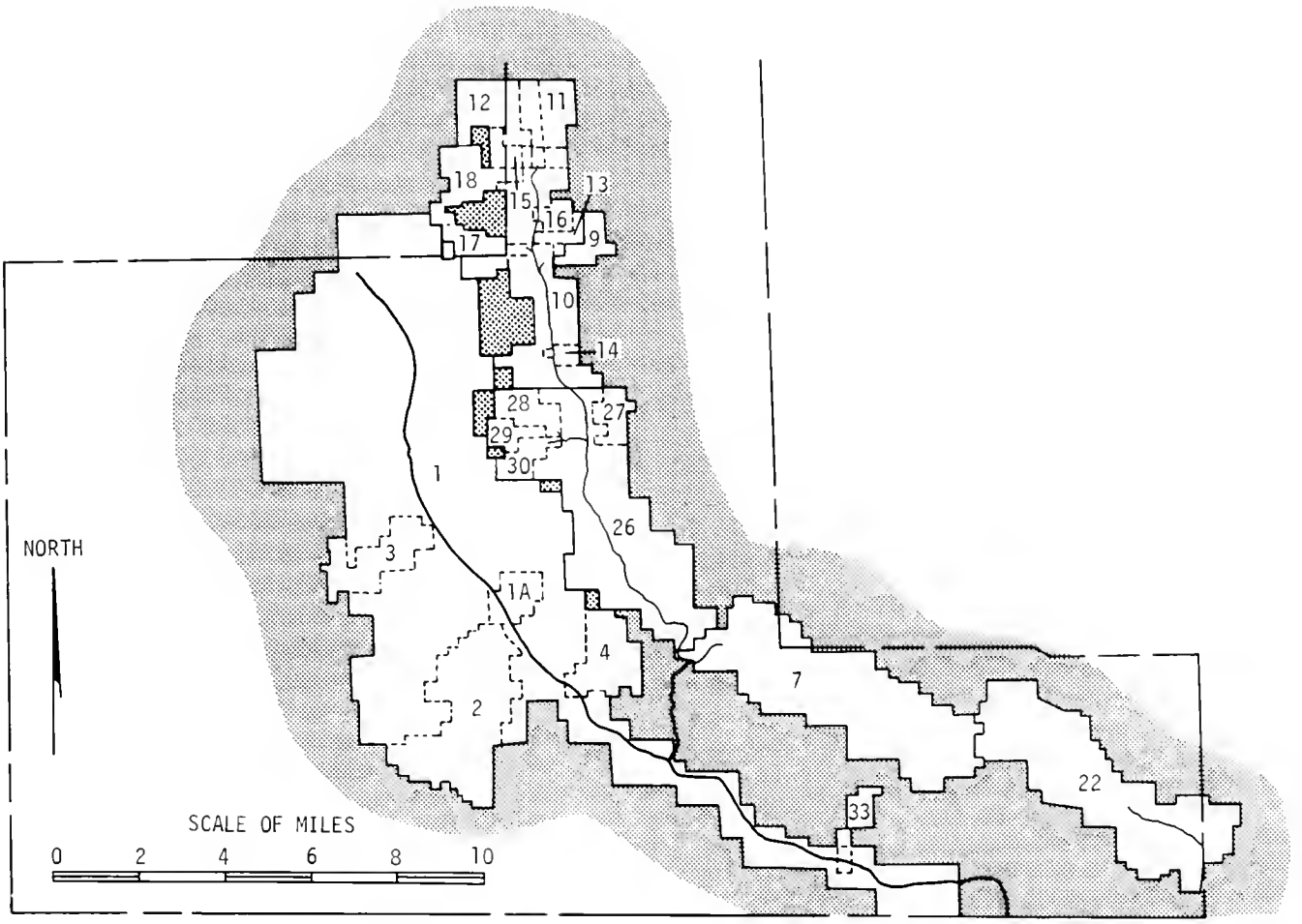

Figure 6. Drainage districts in Ford County. (See table 2 for identification)

Champaign County drainage districts have been obtained for study and are now in the State Water Survey library.

The Champaign County study was made by Hubert Goodell, a consulting drainage engineer. The Ford County report was prepared by Earl G. Johnson, University of Illinois Extension Agricultural Engineer on leave, and the Vermilion County report was done by C. B. Schmeltzer and A. M. Danely, Assistant Engineer Appraisers of the Land Bank Engineer Appraiser Division.

These Land Bank reports review district development and maintenance in Champaign and Ford Counties up to 1934. The Vermilion County report, however, covers only those districts with significant physical or financial problems. This plan seemed to be based on the assumption that districts in good condition, which the appraisers classed A-1, needed no further scrutiny. Hence this report deals only with districts considered to have risks for loans.

Table 1. Drainage Districts in Vermilion River Watershed, Champaign County

District number	Map number	District	Inactive or active	Area (*acres*)	Date organized
1	1	Bailey Branch	IA	1600	1892
2	2	Beaver Lake	A	35,276	1880
3	3	Big Tile Ditch Co.	IA	1200	1901
4	6	Buck Creek Mutual	IA	2315	1928
5	8	Conkey Branch Special	A	3260	1908
6	11	Dillsburg Special	A	3088	1917
7	14	No. 10 Town of Ogden	A	789	1900
8	15	No. 11 Town of Ogden	IA	647	1901
9	19	No. 1 Town of Sidney	A	2274	1898
10	20	No. 2 Town of Sidney	IA	2185	1908
11	21	No. 1 Town of S. Homer	A	4125	1893
12	22	No. 3 Town of St. Joseph	A	6293	1880
13	23	No. 4 Town of St. Joseph	A	4619	1880
14	24	No. 5 Town of St. Joseph	IA	410	1881
15	25	No. 8 of St. Joseph Twp.	IA	865	1910
16	26	No. 1 of Stanton Twp.	A	2070	1908
17	30	Ehmen-Schmidt Mutual	IA	1050	1928
18	33	Flatville Special	A	7202	1909
19	36	Hickory Grove	IA	*	1920
20	41	Kerr & Compromise	A	1835	1913
21	42	Killbury Mutual	A	60	1924
22	47	Mutual of Harwood Twp. (Watson Claypool)	IA	1420	1880
23	48	Mutual of Harwood Twp. (Clifton Shelton)	IA	490	1882
24	56	Raup	A	3078	1926
25	57	Salt Fork	A	7151	1904
26	58	Saline Branch	A	16,182	1906
27	60	Schindler	IA	566	1906
28	61	Schneider	IA	849	1925
29	63	Silver Creek	A	5088	1909
30	64	Spoon River	A	21,302	1903
31	65	South Fork	A	3137	1903
32	66	St. Joseph No. 6	A	720	1881
33	67	Stanton Special	A	3973	1908
34	69	Triple Fork	A	4175	1929
35	71	Union of Stanton & Ogden Twps.	A	2150	1900
36	73	Union No. 1 of Ogden & Oakwood	A	13,000	1880
37	76	Union No. 1 of Philo & Urbana	IA	2284	1907
38	79	Union No. 2 of Somer & Stanton	A	9117	1901
39	80	Union No. 1 of S. Homer & Sidell	IA	2110	1882
40	81	Union No. 2 of S. Homer & Sidney	A	4380	1894
41	82	Union of S. Homer & Sidney	A	1120	1896
42	83	Union No. 2 of St. Joseph & Ogden	A	3931	1880
43	84	Union No. 7 of St. Joseph & Ogden	IA	840	1909
44	86	Upper Salt Fork	A	9668	1925

Table 1 (Concluded)

District number	Map number	District	Inactive or active	Area (*acres*)	Date organized
45	87	Urbana and Champaign Sanitary	A	5503	1934
46	88	West Branch	A	1880	1906
47	90	Willow Branch	A	1005	1902
48	91	Wrisk	A	1736	1904
49	92	Youman's Branch Mutual	IA	1679	1929
50	93	Harwood and Kerr	A	3958	1925
51	95	Ludlow Special	A	2540	1948
52	96	Somer Township No. 1	A	2300	1950

Note: *indicates no record

Table 2. Drainage Districts in Vermilion River Watershed, Ford County

District number	Map number	District	Inactive or active	Area (*acres*)	Date organized
1	1	Big Four	A	41,226	1899
	1A	Subdistrict No. 9 of Big Four	A		1900
	2	Subdistrict No. 11 of Big Four	A		1905
	3	Subdistrict No. 12 of Big Four	A		1902
	4	Subdistrict No. 4 of Big Four	A		
2	7	Ford Special	IA	8080	1909
3	9	Little Lyman	A	720	1903
4	10	No. 1 of Lyman Twp.	A	5040	1895
	11	Subdistrict No. 1 of Lyman Twp.	IA		1900
	12	Subd. No. 2 of No. 1 Lyman Twp.	IA		1900
	13	Subd. No. 3 of No. 1 Lyman Twp.	IA		1900
	14	Subd. No. 4 of No. 1 Lyman Twp.	IA		1900
	15	Subd. No. 5 of No. 1 Lyman Twp.	IA		1900
	16	Subd. No. 6 of No. 1 Lyman Twp.	A		1900
	17	Subd. No. 8 of No. 1 Lyman Twp.	IA		1902
	18	Subd. No. 9 of No. 1 Lyman Twp.	IA		1903
5	22	Sugar Creek	A	6560	1907
6	26	Wall Twp.	A	8440	1892
	27	Subdistrict No. 1 of Wall Twp.	IA		1899
	28	Subdistrict No. 3 of Wall Twp.	IA		1899
	29	Subdistrict No. 4 of Wall Twp.	IA		1899
	30	Subdistrict No. 5 of Wall Twp.	IA		1899
7	33	Shelby-Cleary Mutual	IA		1931

Table 3. Drainage Districts in Vermilion River Watershed, Vermilion County

District number	Map number	District	Inactive or active	Area (acres)	Date organized
1	1	Alvin	A	3903	1908
2	2	Antioch	IA	2165	1934
3	3	Bean Creek	A	5226	1895
4	4	Beneficial	IA	2600	1917
5	5	Bismark	IA	2040	1959
6	6	Bridgeman	IA	3190	
7	7	Brougher	A	1600	1921
8	8	Butler Branch	IA	2800	1918
9	9	Center Creek	A	1263	1921
10	11	No. 2 of Vance Twp.	IA	330	
11	12	No. 1 of Blont Twp.	IA	*	
12	13	No. 1 Town of Ross	IA	1420	
13	14	No. 2 Town of Ross	IA	2272	1912
14	15	No. 1 of Grant Twp.	A	6782	1881
15	16	Eight Mile	A	5452	1911
16	19	Feather Creek Union No. 1 of Oakwood & Pilot Twps.	A	1630	1906
17	20	Feather Creek No. 2	A	1605	1925
18	21	Grape Creek	A	3216	1915
19	22	Green	IA	526	1918
20	24	Hammel Mutual	IA	457	1925
21	25	Henning	IA	894	1912
22	26	Hoopeston	A	6863	1910
23	29	Jamesburg Special	IA	4207	1912
24	30	Johnson	A	5038	1925
25	31	Jordan Special	IA	8623	1906
26	34	No. 1 of Oakwood Twp.	A	1520	1908
27	35	No. 4 of Oakwood Twp.	IA	*	
28	36	No. 6 of Oakwood Twp.	IA	*	
29	37	No. 7 of Oakwood Twp.	IA	980	1908
30	38	No. 8 of Oakwood Twp.	IA	930	
31	39	No. 9 of Oakwood Twp.	IA	150	
32	40	No. 12 of Oakwood Twp.	IA	438	1919
33	41	Pleasant Hill	A	1990	1918
34	42	Pleasant View	IA	2018	1918
35	45	Ross Twp. Mutual	IA	1215	1925
36	46	Rossville Union No. 1 Towns of Ross & Grant	IA	*	1923
37	47	Sinking Hole	A	2015	1913
38	48	Special of Vermilion & Champaign Counties	IA	422	1895
39	49	Stoney Creek	A	11,076	1906
40	52	Union No. 3 of Grant & Ross	IA	*	
41	53	Union No. 1 of Newell & Ross	IA	2587	1905
42	54	Union No. 2 of Oakwood & Pilot	IA	1990	1909
43	55	Union No. 1 of Oakwood & Vance	IA	740	
44	60	Union No. 1 of Vance & Catlin	IA	2164	1910
45	61	Union No. 1 of Vance & Sidell	IA	8545	1880
46	63	Westville	IA	363	1920

Note: * indicates no record

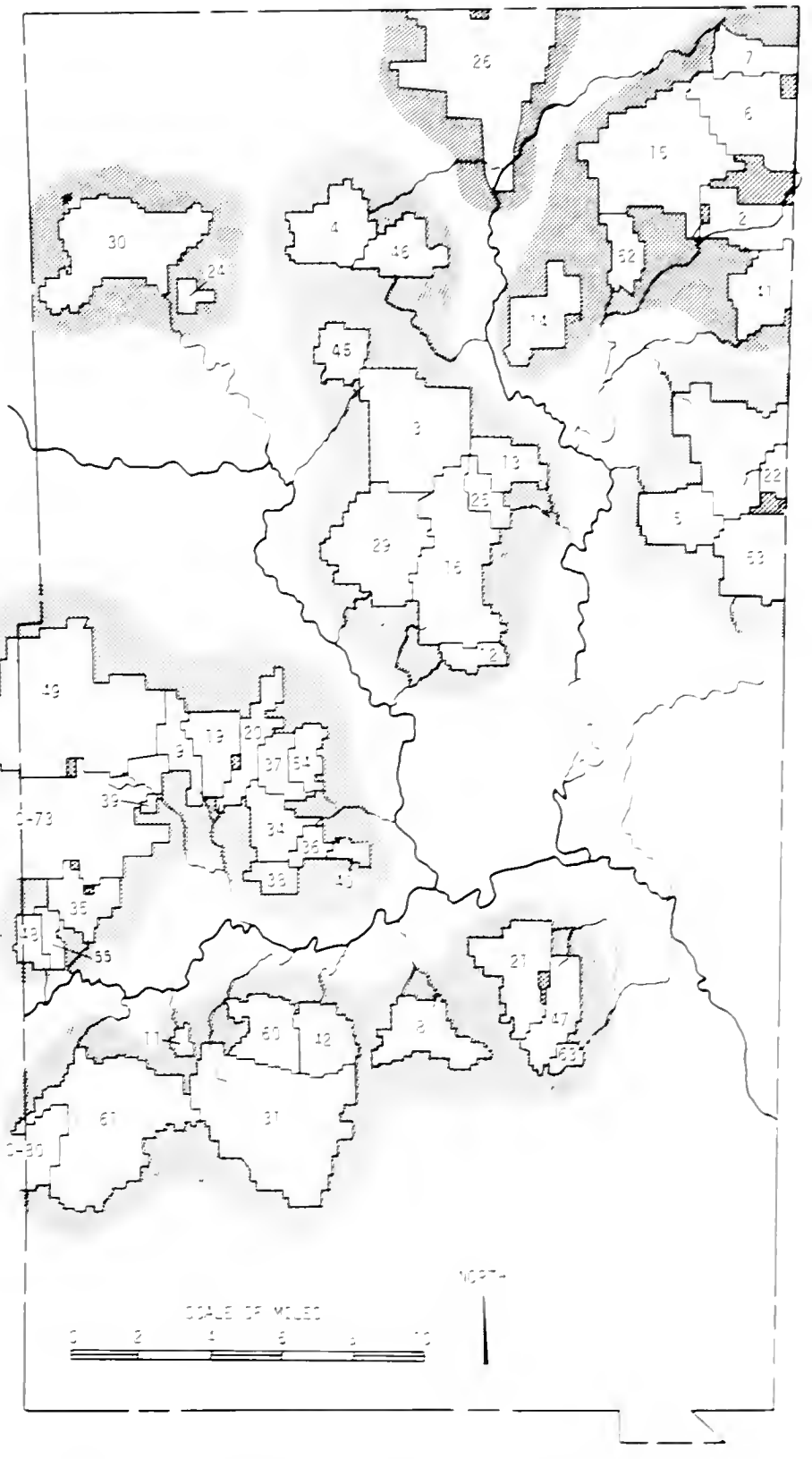

Figure 7. Drainage districts in Vermilion County.
*See table 3 for identification.

Recent plat books of the three counties have also been used, but channel locations in these are not dependable.

In addition inquiries were sent to offices of five consulting engineering firms and four law firms known to have worked with drainage districts in the area. Interviews were also held with county extension advisers in all three counties and staff of the U. S. Soil Conservation Service and the Soil and Water Conservation Districts. A number of senior citizens of the area have been interviewed. A letter and questionnaire were sent to a commissioner in each of the 55 active districts. The 32 replies received have been helpful in preparing this report.

A major effort in this study has been reviewing records of drainage districts in the courthouses of the three counties. Considerable time has been spent in reviewing the records in the office of the Champaign County Clerk, Dennis Bing, in the county courthouse in Urbana. This office holds 32 file drawers of records of Champaign County drainage districts filed alphabetically and a large case of maps and engineering plans also filed alphabetically. The Circuit Clerk's office in Champaign County has an up-to-date list of drainage commissioners and a brief docket showing recent action taken by drainage districts. Most of the historical material, however, is in the County Clerk's office.

In the Vermilion County courthouse in Danville, the filing order is somewhat reversed. A major part of the drainage district records is in the Circuit Clerk's office but the County Clerk keeps a current list of drainage commissioners.

In Paxton, the Ford County drainage district commissioners are listed in the Circuit Clerk's office along with the docket which contains summarized action taken by the drainage districts over the past 20 years. Older records are in the County Clerk's office but in rather unsatisfactory condition for reviewing since it takes considerable effort to straighten out old brittle maps and the records are kept in no obvious order.

The inventory of the Illinois Department of Business and Economic Development (1971), previously mentioned, lists for the three-county Vermilion River watershed a total of 105 drainage districts (not including subdistricts) organized since 1880, after passage of the Farm Drainage Act and the Levee District Act by the Illinois legislature in 1879. The inventory shows 35 active and 17 inactive drainage districts in Champaign County, 5 active and 2 inactive in Ford County, 15 active and 31 inactive in Vermilion County, making a total of 55 active and 50 inactive drainage districts.

Figure 8 shows the date of organization of districts and some subdistricts in the watershed. It can be noted that most of the districts were organized from 1895 through 1930. The largest number, 10, were organized in 1900 and in 1925.

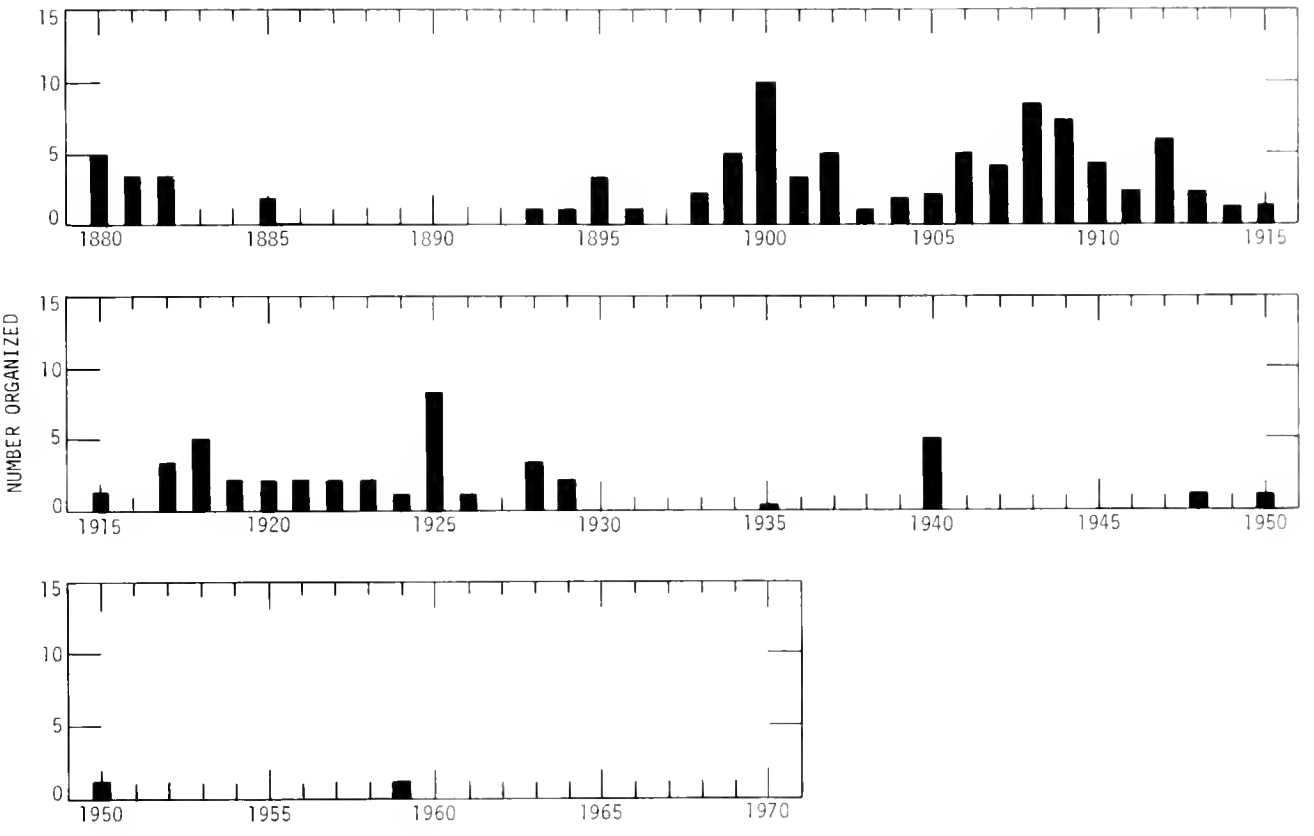

Figure 8. Dates and numbers of drainage districts and subdistricts organized in the Vermilion River watershed.

FROM SWAMPS TO RICH CROPLAND

Early Conditions

Most of the stream channels in the Vermilion River watershed under study have been man-made since the area was settled, and nearly all of this construction has been accomplished since 1880. Thus the natural conditions of land and water as related to the environment prior to that time are of interest. Like much of Illinois 150 years ago, this land was more than half grassland or prairie. Forested areas of any size were located along the three river channels, North Fork, Middle Fork, and Salt Fork, and extended upstream along some of the tributary creeks. The early settlements were all in the wooded areas along the streams, a situation still existing after Illinois became a state in 1818. Most histories of that time are concerned primarily with these settled areas and the transportation between them. The prairies were of little interest to the early settlers except as formidable barriers to be crossed. The flatness of the land and ponding can still be seen in 1974 (figures 9 and 10).

Figure 9. Aerial view of 1974 standing water in fields in Champaign County.

Figure 10. 1974 standing water in Champaign County --surface drainage is needed.

The Illinois prairies were described in early years with awe and even fear. Father Marquette is reported by Jones (1911) to have written: "The vast stretch of prairie present a picture as beautiful and awe inspiring as the first sight of the Great Lakes to the white man." According to the Paxton Record (1959), an early Ford County settler, Mrs. Jane Patton, wrote: "In summer was grass and flowers, tall grass was beautiful, higher than you, but watch for hidden ponds of water." After traveling across south-central Illinois in 1843 an English visitor observed, "This flat prairie is apt to be wet, --if not connected by some water course by which water may escape on the subsidence of the spring freshets. As a general rule the higher the prairie is, the better the soil." A Vermilion County history (Jones, 1911) describes the "raw prairie" with "miles and miles of swamps with a heavy wild grass, and there was no drainage at all. Streams had worn no channels for the water courses."

The 1974 permanent Grand Prairie exhibit in the State Historical Museum in Springfield illustrates the tall cordgrass, flowering plants, and animals originally found in this region. An 1824 map in the Old Capitol Building in Springfield shows this "Grand Prairie" extending through the central part of Champaign and Ford Counties which is the western edge of the Vermilion River watershed.

In central Champaign County just to the east of this prairie the "Big Grove" woodland area of that time extended along the Saline Branch of the Salt Fork River. Some of the first settlements in the area were located along the lower end of the Vermilion River near the present site of Danville. Early settlements in Champaign County were along the Salt Fork at Homer, Sidney, and Urbana, as well as Sadorus on the Kaskaskia, and Middletown (now Mahomet) on the Sangamon (Cunningham, 1905).

Life in early settlements of this region was hard, especially near the swamps which covered much of the area. Frequent use of the terms "slough," "swamp," "flood," "mud," and "lake" indicates the unfavorable conditions. Problems of human health of residents were frequently associated with the swampy land. This dislike for swamps in America dates back to the Virginia colony when the General Assembly passed an act June 7, 1699, to move the original colonial Capitol from swampy Jamestown to Middleplantation (Williamsburg) with the statement, "Middleplantation hath been found to be healthy and agreeable to the Constitutions of ye inhabitants of ye Majesty's Colony and Dominion having the natural advantage of serene and temperate aire, dry and champaign land" [as noted from a visit to Williamsburg in March 1974].

Early settlers in Illinois held this same desire for higher healthier land. Accounts of early settlers tell of epidemics in the area. Mrs. Patton (Paxton Record, 1959) told of "spotted fever" and "cerebral spinal fever" causing 14 deaths in her sparsely settled community near Paxton in 1857 and 1858. Lottie Jones (1911) wrote that in Middle Fork Township in Vermilion County homes along the creek "had severe sickness and fatalities without exception." Malaria was prevalent in Champaign County as late as 1900, as related by Mrs. Anna Pierce who has resided north of Urbana for over 90 years. There in her childhood days she and other family members were afflicted with malaria every summer and fall.

Other accounts also mention plagues of many flies and mosquitoes. "Milk sickness" was another dreaded disease of that period. This was caused by the consumption of the poisonous swamp plant, White Snake Root, by cows. It not only caused the death of valuable livestock, but also transmitted an alkaloid poison in the cow's milk. Thus children and adults died without warning. It is believed that Abraham Lincoln's mother, who died in Indiana, was a victim of milk sickness. The weed grew profusely in low swampy areas unsuitable for cultivation. After drainage and cultivation of the land, most of this weed was eliminated.

According to Morgan (1969) workers on the Illinois Central Railroad in 1874 found Champaign "one vast pond with a green scum coated surface." They feared "Cholera, milk sickness, ague and fever." "Houses were surrounded by water which stood until covered with green slime" -- swarms of mosquites -- as reported in 1864 in the area about Thomasboro. There were continuous epidemics of "ague" or "autumnal fever," a form of malaria. The usual medication prescribed was "calomel." Tom Ames (1970) wrote that the area about Melvin and Sibley in Ford County was nearly all swampy. Flies and mosquitoes were so bad that men preferred to work in the fields by moonlight. Drainage served to reduce the mosquitoes, before the true cause of ague and malaria was known.

Many areas too swampy to cultivate were grazed by cattle and other livestock in favorable seasons. A Thomasboro senior citizen remembers when many cattle were produced on the bluestem and sloughgrass (probably cordgrass) land now in the lower part of the present Beaver Lake Drainage District in Urbana Township. Figure 11 pictures big bluestem grass. The great prairies of Vermilion County were also used for grazing with only higher portions of fields being farmed. Cunningham (1905) related the cattle raising of B. F. Harris whose animals grazed many "uncultivated patches." He and many other prominent citizens of the Civil War period and later were livestock producers with large herds of cattle in both Champaign and Vermilion Counties, as described in *Portrait and Biographical Album of Vermilion County, Illinois* (1889).

Transportation was extremely difficult at the time of the early settlements. An 1867 map of Vermilion County, which was well settled by that date, shows no through roads. A typical road extended out a few miles from town past several farmsteads only to come to a dead end at one of them. Mrs. Pierce's memory of the Champaign County roads of the 1880s and 1890s is "liquid mud," for few roads were even graveled and water stood in low spots. She remembers a funeral in 1907 when four horses were required to take the hearse from Leverett through the mud to an Urbana cemetery. Frank Meier, now a drainage commissioner for Beaver Lake, remembers his family accounts of crossing swamps on horse back in "water up to the stirrups" in this same area. In Mrs. Patton's (Paxton Record, 1959) early years about 1857 near Paxton, the Middle Fork River could not be crossed for as long as 6 weeks in the spring as no bridge had been built. She remembered that one man drowned trying to cross this stream. Morgan (1969) related that in 1870 Bernard Hannon required a full day to drive 16 miles southwest from Colfax Township to Champaign using four horses to pull a wagon.

Figure 11. Big bluestem, a native prairie grass which grew originally in much of the Illinois swamps.

Even in the early days of automobiles, well drained and hard surfaced roads were rare. A 1916 Chicago Automobile Club Guide Book for Illinois describes a route from Champaign to Chicago through Urbana on East Main Street 1.4 miles east to turn north across a bridge (probably the only good one) on Saline Branch toward Thomasboro and Rantoul. The road to Danville also shows a route through Sidney, Homer, Fairmount, and Catlin thus avoiding crossing the Salt Fork River. Dependable bridges were few and far between even up into the early part of the twentieth century. At that time drainage commissioners were responsible for highway bridges across their ditches. Figure 12 is a view of an early bridge over the Saline Branch main channel.

In its natural state, east-central Illinois was a wide flat to gently rolling swampy expanse covered with tall grass, bluestem and sloughgrass. The few natural stream channels were found in the narrow shallow woodland valleys of the rivers, including the Vermilion of the Wabash. These channels extended into the larger tributary creeks but they became sloughs and swamps farther upstream.

There was little natural surface drainage. Use of drain tile was limited in the early days since hand digging and laying of tile to a ditch or brook somewhere could rarely be done in this area. Too often there were no ditches or brooks of any depth within several miles. A large part of the area could not be farmed until ditches were dug. Hence, much of this swampy land covered with rich black clay loam soil was considered worthless by the early settlers.

Figure 12. One-lane iron bridge built in 1897 over Saline Branch main ditch or channel.

The first farms and villages away from the wooded areas along the streams were on the moraines or ridges. Attempts at farming the lower lands resulted in failures. They could not make a living or live in the swamps. The low valuation of this land is indicated by late dates of purchase of this land from the government even at such low prices as one dollar per acre. The German immigrants who came to Champaign County after the Civil War found only flat swampy land available at low prices. They were pitied and ridiculed when they moved on the land of the present Flatville and Royal communities. A local resident's father, Alex Wilson, was offered a section (640 acres) of swampy land near the present site of Broadlands in an even trade for his riding horse and saddle, but he refused. He knew the flat swamp the landowner offered was worthless. This section of land which he could have had for his horse and saddle might sell for as much as one million dollars at 1974 prices.

Channel Development

Channel improvements and modifications in Illinois have been primarily for drainage and flood control. The exceptions are the large navigation channels such as the Chicago Sanitary Canal first opened in 1848 to connect Lake Michigan with the Illinois River (Cunningham, 1905). The Mississippi, Illinois, and Ohio River channels have been improved and maintained for shipping. The old Illinois and Mississippi Canal connecting the two rivers from Hennepin on the Illinois to the Quad City area on the Mississippi was dug for navigation, but was soon abandoned when railroads were opened. The coming of the railroads

also ended a proposal to construct a canal from Danville to a canal along the Wabash River.

In the watershed of this study, the Vermilion River, practically all channel construction, modification, and improvement have had "drainage and sanitation" as the primary purpose. With the exception of channels in municipalities, this drainage has been for agricultural land. The Boneyard ditch in Champaign-Urbana is the major all-urban channel. However all three major tributaries (the North Fork, Middle Fork, and Salt Fork) also provide outlets for both storm and sanitary drainage for the villages, towns, and cities of the area.

The early attempts to construct drainage channels through the swamps of the area under study were crude, slow, and ineffective. Michael Sullivant, from whom a township in Ford County takes its name, bought 65,000 acres in east-central Illinois (Morgan, 1969). Much of it was so swampy he set out to drain it with a gigantic ditching plow (Ames, 1970) that required 68 oxen driven by 8 men to pull it. They could open 3 to 3.5 miles of shallow ditch in a day.

Teams of horses pulling slip scrapers and men with shovels opened many shallow ditches. These efforts were at best partially effective, as few extended far downstream and most were too shallow for tile outlets. Too often they added to drainage problems on lower land. Disputes, disagreements, law suits, and outright hostilities arose between neighbors over drainage rights, damages, costs, and benefits. Thus drainage was often blocked or delayed by objectors.

The two drainage district laws enacted by the Illinois legislature in 1879 both gave power to a majority of landowners owning at least one-third of the land, or to at least one-third of the landowners holding a majority of the land, to force drainage ditch construction by means of a legal district. Pickels and Leonard's (1921) discussion of legal problems is an excellent review of the steps in district organization and operation required in the formative years.

After organizing and naming drainage commissioners, a district could determine benefits, assess taxes, and use the funds collected to construct drainage ditches as planned across lands and thus provide outlets for those lands within the district. This work by drainage districts has developed through the past century so that with few exceptions, constructed and improved channels within the watershed under study are "district ditches."

Costs for their construction and maintenance have been paid by "benefitted" landowners within the districts. The only financial aid which might be termed public support has been from assessments paid by highway departments and municipalities within the districts. In an exception the Upper Salt Fork received a grant of $25,000 from the state for channel construction. Some Works Progress Administration relief laborers cleared brush, trees, and log jams from a few ditches in Champaign and Vermilion Counties in the depression years of the mid 1930s providing an estimated $60,000 in benefits. Reports also indicate that similar clearing was done on the Big Four ditch in Ford County by Civilian

Conservation Corps crews from a USDA Drainage Camp stationed at Gilman during the same period. Some Champaign County districts obtained similar assistance from another camp at Tuscola. Thus the millions of dollars invested in the drainage channels of these drainage districts and subdistricts has been paid almost entirely from local funds.

Drainage District Organization

This ditching for drainage may conveniently be divided into three periods. The first period extends from earliest settlements and cultivation of the land to 1880. The second period extends from 1880 to about 1955. The third period is just now emerging in the 1970s.

During the first period there was considerable individual and mutual ditching by landowners, but little organized effort involving larger drains. Some mutual drainage channels were constructed but ditching methods were slow and primitive and the channels constructed were shallow and usually inadequate even by minimum drainage standards. Work was often blocked by landowners in downstream locations who feared damage or were unwilling to share costs. Considerable tile under-drainage was also started in this period.

Period two covers organization of drainage districts and construction of the hundreds of miles of drainage ditches still in use in 1974. Figure 8 shows the dates of organization of drainage districts. Most districts constructed ditches within a year or two after their legal organization.

In this period of rapid and extensive construction, numerous tile drains were also installed on farms, and larger tiles were used by many drainage districts as lateral outlets. Some small districts used tile only, with no open ditches, but these emptied into natural open channels most of which had to be deepened, widened, and straightened. The extensive tile systems installed by landowners brought greater demands for deepening and enlarging channels to provide adequate tile outlets. The tile systems have served to remove much of the evidence of the swamps and sloughs that existed originally in the low land areas.

Period two was initiated by the two acts passed by the Illinois legislature in 1879, the Levee District Act and the Farm Drainage Act. They provided for the organization of drainage districts, the appointment of commissioners, surveys and designs for drains, assessment of taxes based on estimated benefits, letting of contracts, construction tax collection, payment for damages, and maintenance. Township commissioners were empowered to approve of drainage districts under the Farm Drainage Act. Hence many drainage districts still bear the name of the township in which they were first organized. District organization under the Levee Act was authorized by the County Courts. These districts were often named for creeks, swamps, or landowners within the districts. County engineers and highway superintendents performed some of the early surveys, but land surveyors and professional engineers were retained by other districts. Among these early surveyors and engineers were Godfrey Sperling, G. L. Fairclo, Ralph Wilson, Joel Dunn, Joseph O'Brien, Hubert E. Goodell,

Alfred M. Danely, Mack H. Kinch, R. E. Fisher, and Professor I. O. Baker in Champaign County; R. O. Hollister and Tracy Pitzen in Ford County; and John F. Fisher and Dale Cronkhite in Vermilion County. The names W. J. Day from Bement, and Troy Timm from Tuscola also appear as engineers on plans.

Attorneys were also retained by most districts, especially under the Levee Act. Some legal firms have continued to serve these drainage districts through several generations. These include J. L. Ray, D. C. Dobbins, D. V. Dobbins, and H. I. Green in Champaign County; Milton Cloud, Franc Thompson, and D. E. Martensen in Ford County; and Jackson Hutton, Ernest Hutton, and George Rearick in Vermilion County. Certain attorneys have become drainage specialists and have represented districts in court cases before the State Supreme Court. Others have participated in writing Illinois drainage laws.

The third and emerging period of drainage began with the new drainage district law or Drainage Code which became effective January 1, 1956 (Hannah, 1969). This law replaced the Levee and Farm Drainage Acts. It placed authority with the Circuit Court, provided management of funds by the County Treasurer, and required annual reports by each district to be filed with the courts and the State Comptroller. The new law has standardized district operations and procedures. In most cases it has simplified the work of district commissioners, especially for levying taxes annually for maintenance.

Since most drains were constructed earlier, maintenance more than construction has characterized this recent period. When applied to strictly agricultural use of land, this has been reasonably satisfactory. However, changes in priorities of an urban society and advanced agricultural technology have brought new problems to drainage districts. Rapid changes in land use from rural to urban residential, industrial, and business now characterize the third period. The adequacy of farm drainage laws and district operation is being severely tested. Flooding tolerated on crop land and pasture can be highly damaging even in a few hours in a residential area. Runoff rates and drainage coefficients used in design for agriculture have become inadequate and even obsolete for more intensive land uses.

Today environmental concern for wildlife, fish and bird life, forests, and open areas must also be considered with every major ditch construction project. In a report of environmental study for Ford County in 1972, Scruggs and Hammond of East Peoria have also suggested that the drainage districts may function as monitors for pollution control by "spotting and correcting violations." All these concerns add complications and challenges heretofore unknown.

Even in agricultural uses, pressure has developed for even better land drainage than exists in 1974 as a requirement in the highly technical, increasingly efficient agriculture of the Corn Belt. Modern agriculture technology now requires better surface and under-drainage. Corrugated plastic drain tubing is used to replace clay and concrete. High speed trenchers with laser beam controls are used to insure proper grades, and land forming is practiced. These improvements contribute to increased agricultural production which is essential for adequate domestic and world food demands. Thus this

new period may be termed one of recognition that society as a whole benefits from land drainage. And so, it becomes a question as to how and to what degree general revenue funds (county, state, and federal) should be made available for drainage.

Channel Location and Design

In the Vermilion River watershed, the larger drainage district channels (such as Saline Branch, Beaver Lake, and Upper Salt Fork in Champaign County; Big Four and Wall Township in Ford County; and Jordan Special and Hoopeston in Vermilion County) were constructed by straightening and enlarging the shallow meandering natural channels. The Upper Salt Fork in Champaign County before improvement was described in the 1934 Federal Land Bank report as follows: "Salt Fork Creek was originally a stream, shallow in depth, tortuous in course, and sluggish in velocity. Its banks were little below the adjoining lands and rainfall of any consequence caused it to be flooded.... As the tributary watersheds became better drained and developed the flooded conditions became worse." Since the district was organized in 1925 and the channel improved, it now has one of the largest channels of the watershed, rivaled only by the Big Four ditch in Ford County.

Many of the smaller ditches were located and constructed through the lowest sections of flat swampy areas where there is little evidence of definite valleys. Natural channels and pools in loops and bends outside the straightened channels have probably been filled through years of cultivation, thus erasing traces of their previous existence. However, the almost complete absence of valleys with definite escarpments or even obvious depressions tends to suggest that few streams existed in the natural state. This is especially true of the lateral ditches and smaller district ditches. This condition is also apparent to one driving on roads across such districts as Beaver Lake and Spoon River in Champaign County and Lyman Township in Ford County. Here ditches are crossed with little warning except for the presence of bridges and leveled spoil banks.

A study of topographic maps readily differentiates the constructed drainage channels from natural streams as the latter are tortuous and meandering. The constructed channels have obviously been realigned to follow straight lines and long smooth curves. Right angle bends are found only in the smaller channels, and these are usually made to follow a road, to pass under a bridge, or at a confluence of two streams. Numerous channels follow a straight line for lengths up to 0.5 mile, and a few are nearly straight for as far as 2 miles. A good example of the results of straightening is found on the Saline Branch ditch in Champaign County. The natural stream length prior to straightening in 1908 was 19 miles from just north of Urbana to the outlet into Salt Fork River near St. Joseph; after straightening the length was reduced to 14 miles. Figure 13 shows new and old channel locations in the western part of this district.

This straightening and improving of the alignment has substantially increased discharge capacity due not only to larger, deeper channels and smoother

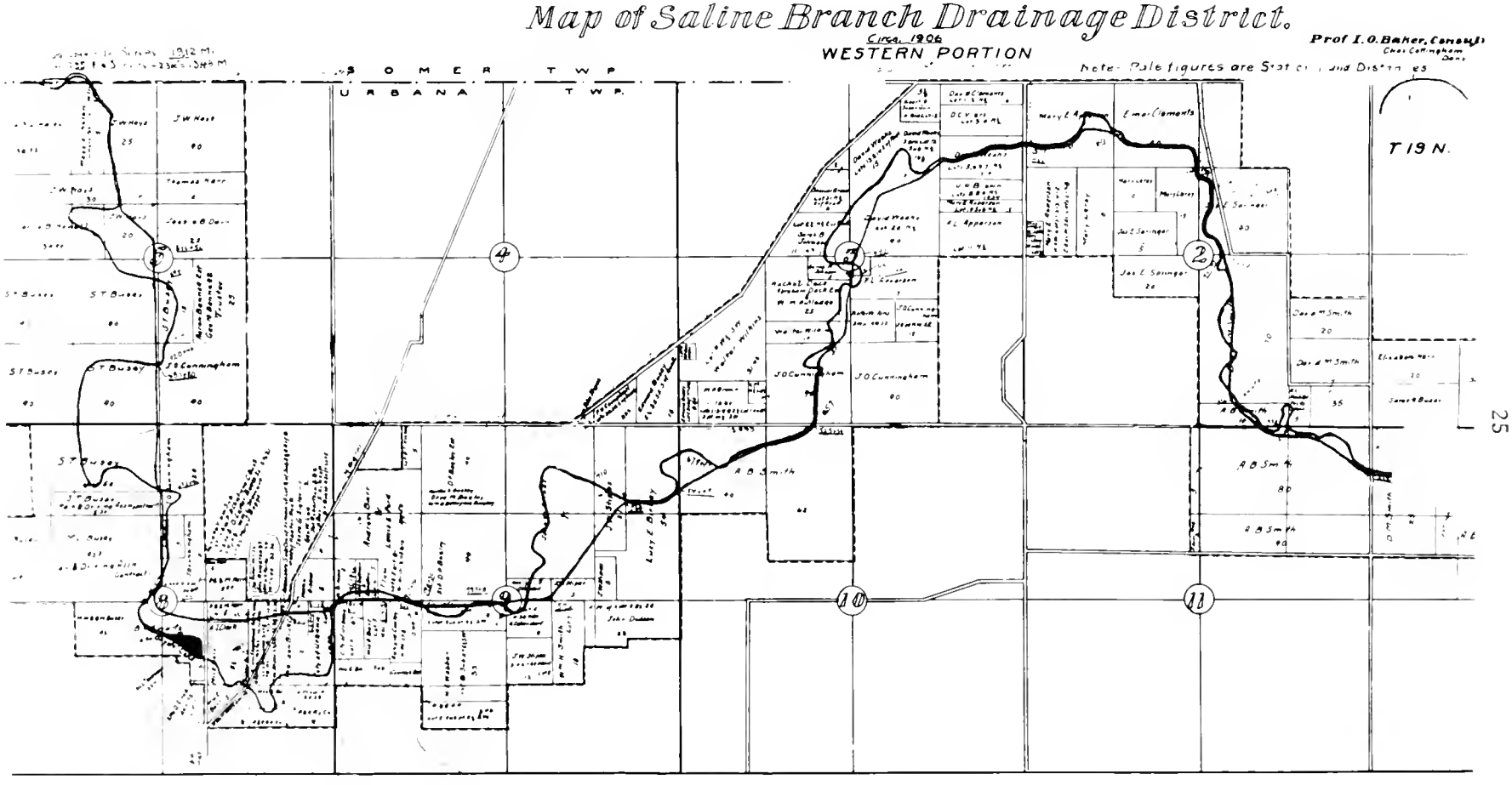

Figure 13. Part of a 1906 map of Saline Branch showing how the channel was shortened from 19 miles to 14 miles.

banks but also to increased gradient. In few if any cases reported has this grade increase produced damaging or erosive velocities. The grade was increased on Saline Branch from 3 to 4 feet per mile (or from 0.056 to 0.076 percent). The grades after channel improvement on the Big Four ditch in Ford County vary from 1.7 feet per mile (0.033 percent) at the lower end south of Paxton to 2.1 feet per mile (0.04 percent) near the Livingston County line. Engineering practice in all these cases has been to design for as much grade as was available. Some drains are still inadequate under these conditions.

In early ditching efforts, channels varied a great deal in size, shape, and depth. Funds, equipment, manpower, and field conditions were controlling factors. Ditches constructed with teams of horses and scrapers or by hand labor in dry seasons were usually shallow, but those constructed with a steam-powered floating dredge boat were sufficiently deep and wide to permit passage of the boat itself.

In 1907 Conkey Branch ditch, which now drains into Homer Lake in eastern Champaign County, was surveyed by Joseph O'Brien, County Surveyor. His records showed an old ditch 2.75 feet deep with a 12-foot top width and 5-foot bottom. He recommended a channel 6.5 feet deep with a 17-foot top width, 4-foot bottom, and 1 to 1 side slopes. This channel increased the cross section by three times and flow capacity even more. It also provided sufficient depth for adequate tile outlets. In 1892 Bailey Branch district south of St. Joseph contracted to have a main ditch dug to a depth of "one to two feet, a top width of 2 scrapers, and 2 foot bottom width." Dirt from the ditch "was to be thrown at least six feet from the margin of the ditch and well scattered." Such a ditch appears to have been typical horse team and slip scraper work. This channel was replaced by a large main tile in 1910 or 1911. These examples typify the early smaller channels.

The larger channels required major construction by qualified contractors. In 1908 the Beaver Lake Drainage District just north of Urbana contracted to construct over 31 miles of channels and install over 20 miles of main tile at a cost of approximately $135,000. Nearly 40,000 cubic yards of earth were moved in the 7-mile main ditch constructed to a depth of 10 to 12 feet. The commissioners proposed in their petition to the County Court "to deepen the ditches but not to widen the same." Thus the banks left were nearly vertical, a shape readily formed by a floating dipper dredge boat. In this operation Beaver Lake ditch was deepened about 4 feet, an advantage made possible by the construction of Saline Branch into which it flows.

In 1907 and 1908 Saline Branch, while being straightened to a 14-mile length, was constructed with a bottom width of 30 feet and to an average depth of about 10 feet. Beaver Lake drainage has been satisfactory since that time. However the Saline Branch outlet, Salt Fork River, was relatively poor. Land along the Salt Fork River channel was finally organized to form the Upper Salt Fork District in 1925 and the first channel improvement was carried out in the years just following. The lower end, improved 5 miles below the Saline Branch outlet, has the greatest capacity of any channel studied. At this lower end below St. Joseph the channel bottom width is 80 feet. A more detailed report

on this large district, which provides an outlet for 15 Champaign County districts, is included in this report under the section on Selected Districts.

Big Four Drainage District in Ford County, the largest district of the watershed, was organized in 1899 to improve the upper end of the Middle Fork of the Vermilion. Starting in southeastern Livingston County about 6 miles northwest of Melvin, the channel extends 25 miles to near the Champaign County line about 6 miles southeast of Paxton. Here it was constructed to its present size in 1938 with a bottom width of 50 feet, a depth of about 11 feet, and 1-1/2 to 1 side slopes. A total of 18 subdistricts have been organized in Big Four to provide lateral drainage outlets. These are all governed by one board of three commissioners, in contrast to the 15 separate districts and boards for the Upper Salt Fork District. The Big Four District is also covered in more detail in the next section.

No district ditches comparable to these larger outlet channels have been constructed in Vermilion County. The Jordan Special ditch south of Fairmount was designed by County Engineer John F. Fisher in 1906. This channel was then constructed with a 12.5-foot bottom and 1 to 1 side slopes on a grade of 3/4 inch per 100 feet (0.06 percent).

Construction

The larger ditches built before World War I were probably dug by "floating dipper dredges," as Elliott (1919) described ditching machines of that period. However, the first mechanical excavator for digging a drainage channel in Illinois is reported by Gain and Petronsky (1973) to have been used in 1883 on the Mason and Tazewell Special Drainage District. Walking dipper dredges, traction dipper dredges, and drag-excavators (draglines) were all in use by 1919.

Accounts of senior citizens interviewed, limited records, and field conditions suggest that the "floating" machines were the ones most commonly used for the early channel construction projects.

These dredges can be described as steam shovels mounted on flat boats. They were assembled and launched to start digging at a pond or pool at the upper end of the ditch to be dug. The lumber, steam boiler, engine, chains or cables, frame, boom, hoists, and shovel were hauled from the nearest railroad by horses and wagons. These were then used to literally "build the dredge boat" [a phrase used in early records of Saline Branch found in the County Clerk's files] at the work site. Then it started by digging a pond large enough to float it, and continued to dig a channel in which it moved as it worked downstream. Upon assembly of the machine, fuel (usually coal) was hauled to the stream bank. A houseboat to be towed behind the dredge was also required with bunks and a kitchen to house and feed the crew. Skilled workmen included the dredge operator and the engineer. The operator was in charge, but the latter put in longer hours. He or his fireman had to keep a fire in the boiler night and day in freezing weather, and had to come on duty before daylight to fire the boiler to build up sufficient steam pressure for

power. A mobile blacksmith shop was also required on the barge to make repairs as needed.

Tales told by senior citizens who watched these dredge boats as children about 1900 to 1910 give some idea of the problems and trials encountered. One told of his great boyish enthusiasm as he watched the lake form just behind the dredge on Beaver Lake and his disappointment as the water disappeared downstream with the machine. A dredge boat operating in Wall Township in Ford County caught fire and burned, thus halting ditching that year. In another story, a wagon preparing to unload coal onto the boat was driven too close to the ditch bank, so that it rolled backward into deep water alongside the dredge. Quick work by the driver to unhitch the horses saved them, but the wagon and fuel were lost. Dredge boat crews usually kept a rowboat for local travel, but horses, buggies, and wagons were also needed. Livery stable bills were included among expense items of drainage commissioners.

Engineering and surveying crews in the field also required transportation, living quarters, and a kitchen. Elliott (1919) lists camping equipment to provide for a party of eight men with recommendations for camping near the work as it proceeded. No doubt many such camps followed the early ditching.

Improved roads, ditchers on crawler tracks or draglines, automobiles, and trucks made the work on channels much more satisfactory by World War I. This probably explains in part the increased drainage district activity in that period.

The floating dipper dredge working from within the stream cut steep banks and deposited the spoil or excavated earth close to the banks. This condition was generally unsatisfactory as it too often resulted in caving ditch banks, and farmers were not equipped to spread the spoil. Neglected banks soon became covered with unsightly brush, weeds, and scrub trees. More recent work with dragline excavators has provided berms or shelves alongside the ditches with the spoil dropped 10 to 20 feet outside the banks. Bulldozers, scrapers, and graders have been used to spread the spoil banks onto the adjoining fields. Some conservation-minded farmers maintain strips of grass and legumes on the leveled spoil banks and berms, thus providing a visually pleasing as well as practical solution to bank stabilization.

REVIEW OF SELECTED DISTRICTS

Big Four Drainage District

Big Four Drainage District is the channelized upper segment of the Middle Fork River. It discharges into a Vermilion County valley in which the controversial Middle Fork Dam and Reservoir proposal is under consideration in 1974. It also drains directly into the area purchased in 1974 by the Champaign County Forest Preserve District for conservation education.

Big Four is the largest drainage district in the watershed with an area of 41,226 acres as reported in the 1971 inventory. In 1920 it was listed as containing 43,320 acres, indicating a loss of more than 2000 acres in the past 50 years. This reduction is probably due to landowner petitions to be withdrawn from the district. There have been no additional districts of this size formed within the watershed. The district was organized in the County Court in 1899 under the Drainage and Levee Acts, as were most districts in Ford County.

This large district had organized 18 subdistricts by 1918. Now 14 of these are presently listed as "inactive" which indicates no maintenance in recent years. A board of three district commissioners is in control and available for any of the 18 subdistricts upon request of concerned landowners.

The district maintains 34 miles of ditches including 25 miles of main ditch. The other ditches are in the subdistricts, and a number of them have only main tile outlets. These tile subdistricts seldom assess maintenance taxes and are thus considered inactive. The main district collects approximately 30 cents per acre for annual maintenance.

The Big Four ditch is also the outlet for three large districts through the East Branch of the Middle Fork. Two of them are Wall Township containing 8440 acres, organized in 1898 with 11 subdistricts, and Lyman Township No. 1 containing 5040 acres which was organized in 1895 with 9 subdistricts. These two districts have a common channel with the Wall Township District below Lyman. The third district channel, Ford Special, also enters the Middle Fork at the lower edge of the Wall Township District. This 8000-acre inactive district has the unusual history of having a channel constructed before any organization was formed. In fact, an attempt to organize in 1909 was unsuccessful because of objections upheld by the Illinois Supreme Court. Thus the ditch remains without any organized taxing body or maintenance. The district border and the improved Middle Fork channel ends nearly 2 miles above the confluence of the East Branch Middle Fork and the Big Four channel west of Paxton. This natural channel gap was most likely left to reduce costs and also to avoid possible assessments by Big Four on the three districts.

According to residents at Melvin, the Big Four ditch was first dug about 1900 with a floating dredge boat. By 1925 silting was causing trouble in the upper end of some ditches and a maintenance assessment of 40 cents an acre was collected for cleanouts. In 1929 Subdistrict 12 charged an average of $13.50 an acre and Subdistrict 9 raised $11.00 an acre for cleanouts. These were high charges for that time.

It is no surprise that numerous objections were filed by landowners. There were also complaints of excessive taxes by owners along the lower part of the ditch and complaints that the owners in the upper part of the district received the major benefits. It was charged that the district was extended downstream into the long narrow area to increase the tax base.

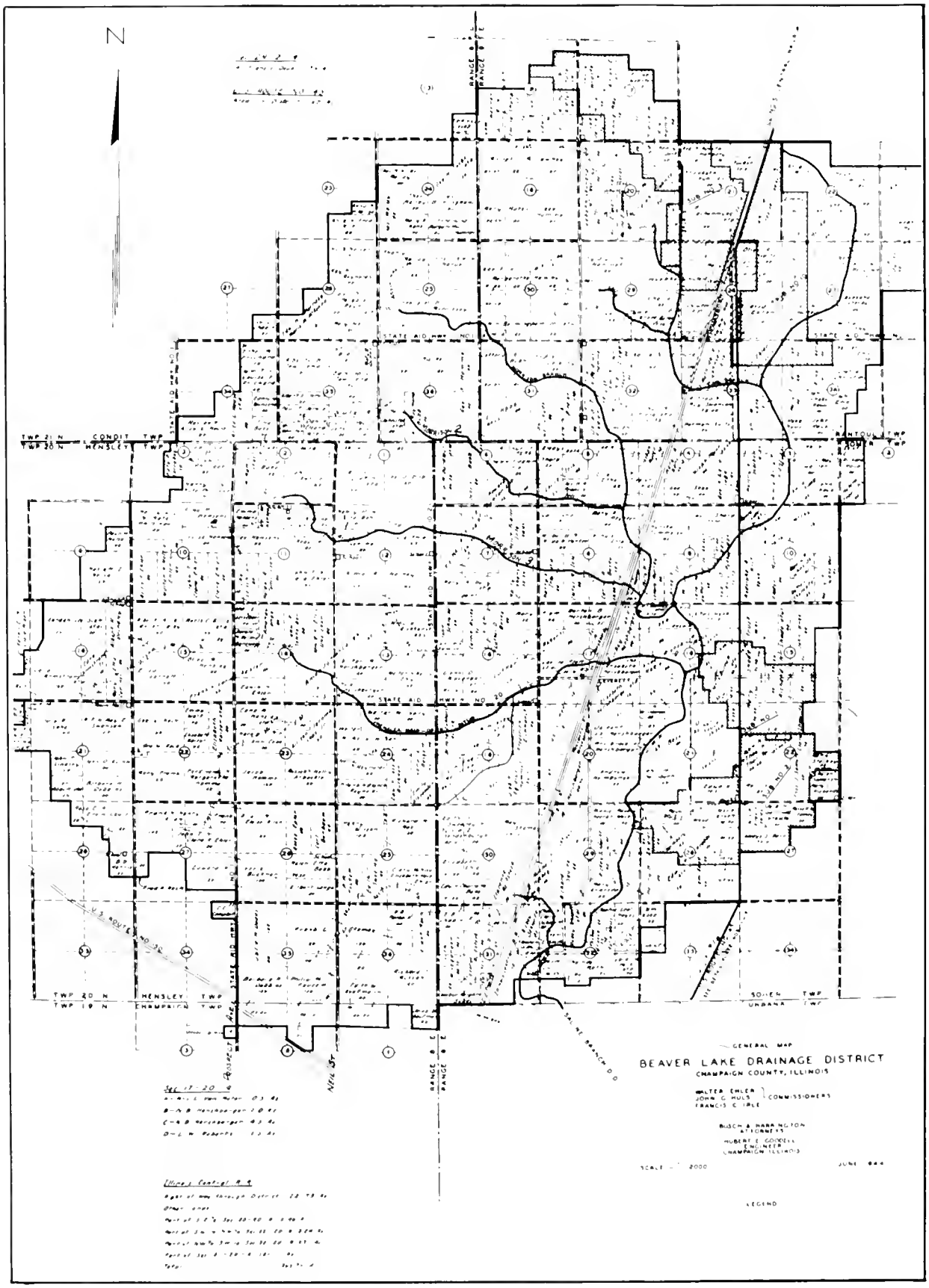

Figure 14. 1944 map of Beaver Lake Drainage District in Champaign County.

However in 1937 the commissioners filed a plan in court for improving the main ditch. The design by R. O. Hollister of Loda specified a ditch with a 50-foot bottom width and 1-1/2 to 1 side slopes at the lower end. This ditch was then constructed by Bayles of Paxton. This is the channel found at present. Some maintenance has been performed. Vail Moore, consulting engineer in Paxton, is now in 1974 preparing plans for another major cleanout and improvement operation on Big Four.

Beaver Lake and Saline Branch

These two districts are reported together, as one channel provides a common outlet for both. Maps frequently show the channel as the Saline Branch of Salt Fork River, the outlet for storm and sanitary drainage from the largest part of Champaign-Urbana. The Boneyard ditch flows into the Saline Branch just east of Cunningham Road, and above the outlet of the Northeast Plant of the Urbana and Champaign Sanitary District.

Beaver Lake is the largest district in Champaign County having an area of 35,276 acres. The petition for organization of this district in 1880 stated that "more than 7000 acres within the proposed district is utterly unfit for cultivation and subject to overflow rendering the same worthless." Another 8000 acres was badly in need of drainage. By 1920 the district area was 32,750 acres. Its location is shown on the map in figure 5. Also figure 14 is a 1944 map of this district. In 1908 Beaver Lake District annexed the 5000-acre Hensley District to form the present southwest segment.

The district name comes from two interesting facts of the natural area. It was sufficiently flat and swampy to form a shallow lake in rainy seasons, and Cunningham (1905) tells of beaver dams found along the shallow meandering stream extending southward through the Big Grove 4 miles north of Urbana. The Beaver Lake area was largely grazing land, too wet for crops when the district was organized in 1880.

Surveys were made and some excavation and channel straightening was performed by 1883. In 1889 a petition signed by 53 landowners asked that the ditch be deepened and widened. Finally in 1889 surveys made by Joel Dunn were used for some ditching. Later, another petition was filed by farmers within the district to voice complaints of neglect and poor drainage. They noted ditches becoming filled, tile outlets obstructed, and crops lost. In 1907 large areas about the villages of Thomasboro and Leverett were covered with standing water. A major energy crisis took place in the loss of hundreds of acres of oats (horse feed) by June and July floods. Floating oats shocks formed jams downstream and others spoiled in the fields. It was "absolutely necessary and essential," the petitioners stated, that the ditches be "cleaned out, deepened, enlarged and repaired." Before the year 1907 ended commissioners T. B. Thornburn, Robert Morrison, and John Carl were removed by the County Court and C. M. Brown, P. P. Hanson, and John McMullen appointed. Whether the new commissioners were more interested and able than their predecessors cannot be judged, for their work was aided by another fortunate event at that time.

Just below Beaver Lake, construction was starting on the main ditch of the new Saline Branch District organized in 1906. This made it possible to deepen the Beaver Lake channel by 4 feet. This deepening and enlarging of the main Beaver Lake channel was under way by the fall of 1908. Hensley District landowners also petitioned to be attached to Beaver Lake at that time, thus increasing the acreage to be taxed. An estimated $135,000 was expended in this major drainage project.

The last special assessment was made in 1920 but annual maintenance taxes have been used effectively. In 1946 consulting engineer Hubert Goodell recommended that 32 miles of channels in this district be cleared of brush and silt. Since that improvement, annual maintenance has kept the channels functioning satisfactorily. The channel condition has been rated "good" by the commissioners in a 1974 questionnaire. The condition of the main ditch in 1974 is shown in figure 15.

It is noteworthy that the lower extension of the present Beaver Lake channel right-of-way ends about 1/4 mile above the upper end of the Saline Branch ditch. Thus the upper district channel does not legally drain directly into the lower one. However the unclaimed section of the stream obviously was deepened by the Beaver Lake District in the construction of 1908 and 1909.

Action to organize the Saline Branch District and construct the channel was started in the Champaign County Court in July 1905 by attorneys H. I. Green and Ray Dobbins. In 1906 commissioners Robert Penman, Thomas B. Thornburn, and John D. Lester were appointed. They engaged Charles Cottingham to make the initial surveys. The initial cost estimate prepared was nearly $80,000. The petition

Figure 15. Main ditch of Beaver Lake Drainage Ditch in 1974, a well-maintained channel but in need of some brush removal.

reported a need for improved drainage for Champaign-Urbana through the Boneyard ditch as well as for the farm land of the 18,900-acre district. The assessed area, however, is listed as 16,182 acres in the 1971 inventory. The 1907-1908 construction shortened the channel by over 5 miles and deepened it by several feet. A dam across the old channel at Market Street (now Broadway) in the northern city limits of Urbana caused some concern. The problem was solved in the realignment which bypassed this location. Thus the dam and Crystal Lake remained much as it exists in 1974 in a severed loop of the natural stream. After the ditch construction the district paid the city of Urbana $29,800 for seven bridges in December 1910, and in September 1913 it shared a $6500 bill for ditch bank maintenance with the Urbana Park District.

By 1934 the Saline Branch channel was in need of maintenance. In the period immediately following, the district received the equivalent of $60,000 in materials, Works Progress Administration labor, and funds from the U. S. Government which were expended in clearing, widening, straightening, and deepening the channel. After this work it was estimated that Saline Branch improvements had cost approximately one-quarter million dollars over 30 years. Records contain a suggestion that Beaver Lake District should have paid a proportionate share of one-third of that sum, but this was obviously ignored.

In February 1949, by court order, a contract was negotiated between Saline Branch and the Urbana and Champaign Sanitary District to detach the sanitary district lands from the drainage district. The sanitary district has continued to support maintenance of the drainage district.

In February 1970, Wilson and Anderson Consulting Engineers, Urbana, reported to the Saline Branch District that extensive maintenance and improvements were needed on the channel. A major portion of the needed work consisted of clearing trees and brush from the channel and stream banks. The sanitary district agreed to share the estimated cost of $125,000. The petition submitted to the Circuit Court was approved in 1973, but objectors, primarily environmentalists, appealed. Thus no action had been taken on this improvement as of June 1974. Such a delay may reduce the extent of improvements because of increasing prices and costs. Figure 16 is a view of the main ditch of the Saline Branch in its 1974 condition, in need of brush removal.

Saline Branch District added two subdistricts early in its organization and added four more in 1940. All six have installed lateral drains through large tile; none has open channels. Interstate 74 construction intersected several of these drains and created problems not entirely solved to date.

Beaver Lake, in contrast, has no subdistricts. However it has constructed and maintained seven lateral channels shown as "branches" and "spurs" of branches as shown in figure 14. This arrangement, with general annual taxation, seems to provide needed flexibility to maintain the drainage system more effectively than the organized subdistricts do.

These two districts are presently undergoing significant land use changes resulting from increasing urban population of Champaign-Urbana and the addition

Figure 16. Main ditch of Saline Branch Drainage District, 1974, with 40 years' growth of trees, badly in need of clearing.

of business and industrial areas. New residential subdivisions and mobile home courts are replacing crop land. In addition two more shopping centers are under construction in 1974. Dozens of new homes also have been built outside the city limits for miles along the stream especially in the Saline Branch District.

These new rural residents and landowners, many with little or no agricultural interests, now outnumber the farm owners. They often prefer to keep the stream untouched and retain tree growth, which reduces stream velocity and channel capacity, unless their own homes are affected by floods. Their opposition to the present plans for Saline Branch improvements may be an indication that such opposition will increase in the future. To complicate the problem, changes in land use also increase drainage and flooding problems. The present channels, designed primarily for agricultural drainage, may be expected to require greater capacity and better maintenance in the future.

Upper Salt Fork

An early attempt in 1910 to organize a drainage district, the Lower Salt Fork, to improve the shallow tortuous, sluggish stream in the area east of Rantoul toward St. Joseph and Sidney failed. Isham (1912) recommended this district be organized to drain 168,000 acres.

Table 4. Districts Draining into the Upper Salt Fork Channel

District	Inventory number	Date organized	Area (*acres*)
Draining directly			
Dillsburg	11	1917	3088
Ehmen Schmidt	30	1928	1050
Flatville	33	1909	7202
Raup	56	1926	3078
Salt Fork	57	1904	7151
Saline Branch	58	1906	16,182
St. Joseph No. 3	22	1880	6293
St. Joseph No. 4	23	1880	4618
St. Joseph No. 5	24	1881	410
Stanton No. 1	26	1908	2070
Stanton Special	67	1908	3973
Union Somers Stanton No. 2	79	1901	9117
Spoon River	64	1903	21,302
Union St. Joseph & Ogden	84	1909	840
Union Stanton & Ogden	71	1900	2293
Youman's Branch	92	1929	1679
Upper Salt Fork	86	1925	9668
Subtotal			100,014
Draining through another channel			
Beaver Lake	2	1880	35,276
Big Tile	3	1901	1200
Ludlow Special	95	1948	2540
Triple Fork	69	1929	4175
Wrisk	91	1904	1736
Subtotal			44,927
Total area			144,941

In 1925 a second petition to organize this same area in a district under the name Upper Salt Fork was approved in the Champaign County Court. By this time at least 16 drainage districts had been organized within the watershed and 5 more have been added since. Sixteen of these 21 districts open directly into the Upper Salt Fork ditch. (There are also 12 overlaps of territory within these districts.) The other five, including Beaver Lake, drain through channels leading into it. Thus Upper Salt Fork is a major outlet district. These 21 districts are listed in table 4, which also gives the inventory number assigned by the Illinois Department of Business and Economic Development (1971).

The first assessment was made by the Upper Salt Fork District in 1930 for $98,585 plus judgments of $60,755 against 13 of the districts listed in table 4, making a total of $159,340 collected.

In 1930-1931, 19 miles of the channel were constructed with a 60-foot bottom width and 10-foot depth at St. Joseph and continuing upstream to a

20-foot width northeast of Rantoul. The cost was $137,000. Attorneys for the district were Dobbins and Dobbins, and the engineering was performed by C. B. Schmeltzer and Alfred M. Danely. The first commissioners were Carl Menninga, Elmer Ehler, and Louis B. Holtapp.

In 1932 a grant of $25,000 by the Illinois Division of Waterways was used to extend the constructed channel with an 80-foot bottom width for 4-1/2 miles downstream from St. Joseph. This is essentially the Upper Salt Fork River channel as it exists today.

Extending the channel improvement on downstream to Sidney to form a South Salt Fork District was considered but no action was taken. It is interesting to note that the Illinois Department of Business and Economic Development (1971) in its inventory lists this Lower Salt Fork District but shows no date of organization or map of its proposed location.

Need for annual maintenance on the Upper Salt Fork, the largest constructed channel in the Vermilion watershed, was soon recognized by the commissioners. The 1939 records express a need for the district to "own, maintain, and operate an excavating machine commonly called a dredge boat" [They actually meant a "dragline"]. With County Court approval, a used dragline was purchased from W. H. Troike of Monticello for $2750. It was a 1927 Northwest Model 2 with a 3/4 cubic yard bucket and a 40-foot beam, operated by a Wisconsin engine on crawler tracks. It was then operated for several years to remove drifts, sand bars, and growths of willows and other brush.

In 1961 the commissioners petitioned the Court for authority to raise funds for additional work and annual maintenance to be paid in part by the 16 districts draining into it. This created a storm of opposition by a new generation of landowners who had forgotten their substantial benefits starting 30 years earlier. Objections were filed in court by all districts. Motions to strike objections, interrogations, objections to interrogations, answers, motions to compel answers and compliance, proof of services and more answers added dozens of lengthy legal papers to the records and led to a trial before Judge Frederick Green in November 1963. Compromises were finally reached approving special assessments and reduced payments by upstream districts, but limiting annual maintenance assessments to the Upper Salt Fork District. This costly and time-consuming action accomplished no drainage benefits, and added complications and confusion for the future of this major drainage project. Figure 17 is an aerial view of the Upper Salt Fork main channel between St. Joseph and Sidney. Figure 18 is a ground view of the same channel.

Grant Township No. 1

The channel of this northeastern Vermilion County drainage district flows into the Middle Branch, a tributary of the North Fork of the Vermilion River. It is 6613 acres in area, and second only to the Hoopeston District in the 14 districts of the North Fork watershed. There are no districts in Vermilion County comparable to the large ones in Ford and Champaign Counties. Grant No. 1 has been chosen as a typical upland district of that area, with an open ditch outlet channel and tile.

Figure 17. Aerial view of channel of Upper Salt Fork Drainage District, 1974, 80-foot bottom width.

Figure 18. Channel of Upper Salt Fork Drainage District.

The district was first organized under the Farm Drainage Act in 1881 by the Grant Township Board. No early records have been found. However, Dale Cronkhite has supplied some information, since his grandfather, Samuel Smith, was an early commissioner. It is believed that the first ditch was dug with a dredge boat, and some large tile mains were also installed.

Dissatisfaction with the performance of this early drainage led to its reorganization under the Levee Act in the County Court in 1923. Records in the Circuit Clerk's office are quite complete since that date.

In February 1924 a petition was filed for approval of an assessment to improve the district drains for "agricultural and sanitary purposes." The newly appointed commissioners were Arthur Butzow, Charles E. Cox, and Roy Brougher. R. O. Hollister of Loda was engaged to do the engineering and Clark and Hutton of Danville were the attorneys.

In the construction of 1925 and 1926 by W. F. Steinberg of Piper City, the outlet channel was extended 5155 feet downstream with a fall of only 1.86 feet in that distance. The channel had a 6-foot bottom width, 1-1/4 to 1 side slopes, and an 8-foot clear berm with earth deposited on both sides of the ditch.

A number of objections to the assessments created delays in court and in collecting. The Chicago, Milwaukee, St. Paul and Pacific Railroad objections were especially difficult. The 1934 appraisal of the Federal Land Bank rated this district in fair condition and noted its $6784 indebtedness.

The ditch was last cleaned out in the early 1950s with engineering services by John Walker of Loda, the successor to Mr. Hollister. According to Mr. Cronkhite, the drainage is now about 80 percent effective. There is "sloughy land" in both the west and northeast parts of the area, due he believes to inadequate tile mains. This district seems in need of major construction and maintenance to meet the needs of modern intensive agricultural production.

APPLICATION OF STUDY TO WATER RESOURCE PROBLEMS

Channels are man's most common method of conveying water, and hundreds of miles of "man-made" channels have been constructed in the past century in the watershed studied. These vary considerably in age, dimensions, soil conditions, maintenance, hydraulic efficiency, and capacity. Many more such drainage channels are found throughout the state, and their evaluation is worthy of consideration.

The historical study reported here is a reminder of the vast amount of brutally hard work and sustained effort that has been contributed by thousands of people to establish the improvements and conveniences that are now accepted as normal by almost everyone. Discussions of the environment today include an assumption that this prairie land was originally lush, productive, scenic,

refreshing, stimulating, healthful, "unpolluted," and so on. In contrast, history reveals impassable and unusable swamps and the prevalence of fever and disease. Today's generation and especially urbanites need an accurate picture of the natural condition of the land in order to perceive and solve land/water resource problems.

Even intelligent, progressive people sometimes do not know or tend to forget what original conditions were like. A case is described by Ben Muirheid of Champaign. Objectors were opposing improvements on East Lake Fork ditch between Bondville and Ivesdale. Joseph Giblin, farm manager and landowner, now deceased, was in vigorous opposition. He appeared in court in opposition with the claim that his land had "natural" drainage, that it didn't need the improvements. He was a good witness and his opposition was damaging until Donald V. Dobbins obtained the Swamp Act Ledger from the County Court files and pointed out to Giblin that his land was originally swamp. Only after East Lake Fork ditch was constructed did the land become of value and the swamp change to highly productive farm land. It is easier to understand how urban people can be utterly misinformed when one learns that even professional farm managers may lack knowledge of the basic history of land.

Many Illinois drainage channels and tributary tile drainage systems are essential to the productivity of some of the best crop land in the nation. Their maintenance and efficient performance is vital to our nation's food production. The deep dark soils drained by tile and open channel drainage have a high capillary water retention capacity, thus providing a sponge-like effect on peak flow from these watersheds. Tile flow tends to continue all year except in the driest seasons and periods of rapid evapotranspiration by crops. Thus the water retention advantage claimed for "wet lands" also exists in well-drained lands that were originally swampy.

Since drainage channels carry a high proportion of runoff water, the quality and quantity of this flow is significant in design and performance of reservoirs and to river channels downstream. There is no evidence of any attempts to manage or control drainage ditch flow for better utilization downstream. However, control structures could be built at some locations and deserve consideration. Monitoring and possible control of pollution in water flowing through drainage channels has been suggested. Runoff control and management in these man-made channels may be more workable than in natural streams. However, present drainage commissioners and landowners will need support and guidance for any effective action which can have significant environmental benefits.

Existing flood control reservoirs in central Illinois such as Lake Shelbyville and the proposed Lincoln Lake and Springer Lake, all Corps of Engineers projects, have extensive drainage channels both below and in their watersheds. Serious interference with these drainage channels by the reservoirs at high flood stages is being predicted. Here again there is a real need to study problems of existing reservoirs and those under design to avoid damage to drainage channels and adjacent lands. This also applies to reservoir projects for recreation and for power plants.

The present existence of hundreds of small drainage districts, each a separate unit of local government, complicates and confuses the situation. Far too many of these districts are inactive with no commissioners named for many years and no operating funds. Some channels have had little or no maintenance since their initial construction. Instead of open channels some small districts have tile lines which are inadequate. Most tiles were installed 50 to 90 years ago and are now showing breaks and other signs of failure. Channels may prove to be more satisfactory for replacements.

Present day land use changes, regional planning, and efforts to consolidate the many small local governmental units may have a significant impact on drainage districts and the future operation and maintenance of their many channels.

SUGGESTIONS FOR FUTURE STUDIES

This project has been conducted on an exploratory basis. It has been limited to one watershed primarily because of its proximity to Urbana-Champaign and the high concentration of small and moderate size man-made drainage channels developed by districts. Studies in this detail cannot be justified on a statewide basis. However the authors hope that some aspects may be applicable in other watersheds or regions for water resource studies and projects.

1. Further Historical Research

This attempt by engineers to be historians cannot be expected to satisfy students of history, but it may serve to develop interest in the extensive efforts of the past. Efforts of landowners, farmers, attorneys, engineers, highway superintendents, and contractors of the past century have developed the thousands of miles of channels in Illinois drainage districts. There are opportunities for many historical studies of these open drainage channels and also tile drains.

2. Need for Changes in Drainage Districts

The writers believe that development of some appreciation for drainage channels constructed in the past may serve to create perspective for the present and future. Evidence points to the need for major changes in drainage channel improvements in the future. Regional planners, engineers, attorneys, landowners, and industrial concerns may expect to be involved. Drainage district involvement with other units of local government and possible mergers must be considered. Possible public benefits compared with recognized direct private benefits to those along the channels need to be determined and evaluated. Such considerations are being approached in 1974 by a Subcommittee on Drainage Districts in the Water Pollution and Water Resources Commission set up by the Illinois legislature. This is an encouraging initial move.

3. Channel Characteristics

Engineering studies of the performance of existing drainage channels are also recommended. Study is especially appropriate in those watersheds under-

going land use changes from agricultural to urban and industrial uses that are altering runoff characteristics. Even in agricultural areas, rapidly developing technology demands better soil and water management. Thus the present drainage channels designed for a half century ago will require modifications and improvements.

4. Cooperation with Highway Departments

There are undeveloped opportunities for cooperation between highway engineers and drainage districts. In the early years of channel construction, county surveyors divided their time between roads and drainage. This close coordination was lost for a number of years. Drainage districts and landowners have complained of damages because of blocked drainage by highways. A memorandum of the Illinois Division of Highways (1967) is intended to bring about better cooperation and should lead to practices beneficial to both highways and adjacent fields.

5. Cooperation with Fish and Wildlife Interests

Another significant challenge in drainage channel research and design is in the preservation of fish and wildlife habitat along drainage channels. This calls for cooperation with biologists to determine the desirable features in natural streams and their incorporation in man-made channels. Here public benefits must pay for added costs, and compromise, cooperation, and imagination will be required. The effort expended in opposition to channelization may better be directed to constructive effort. Surely engineers and fish and wildlife specialists can develop channels that will provide not only adequate drainage relief but also desirable habitat for fish and game. A recent publication by the Soil Conservation Society of America (1973) contains useful information on this subject.

6. Pollution Control

Finally, the possibility for monitoring and controlling of pollution in water flowing through drainage channels is another challenge involving engineering research. As in other cases, such studies must begin with the existing drainage channels.

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